INSTRUCTIONS ON THE OBSERVATION AND REPORTING OF LIGHTNING STORMS

FOREST SERVICE - UNITED STATES DEPARTMENT OF AGRICULTURE
NORTHERN ROCKY MOUNTAIN FOREST EXPERIMENT STATION
IN COOPERATION WITH DISTRICT 1 APRIL, 1930.

OCCURRENCE OF LIGHTNING FIRES

Better suppression of lightning fires is one of the major objectives of the forest-protective organization in the Northern Rocky Mountain region. The man who tries to contribute his share toward the attainment of this goal is much more valuable than the man who makes no special effort to do so. The opportunity lies, not in reducing the number of lightning fires, but in anticipating and suppressing them so that the smallest possible number reach Class B or Class C size.

ACTION AT LOOKOUT STATIONS IMPORTANT

Of all the men in the Forest Service, the lookout should be the best informed concerning the cause and the occurrence of lightning fires. A lookout can usually see a storm hours before it sweeps over his district, and hours before the fires started by that storm smoke up enough to be located. Some experienced lookout men have learned to recognize the fact that certain types of lightning storms are very dangerous, certain others start only one or two fires, while others start none at all. The experienced lookout realizes that by sizing up the storm as it approaches his district, he can often phone down to headquarters and give a pretty fair warning of whether or not to expect fires, and the approximate country in which they will occur. This is extremely valuable information for the district ranger and the Supervisor. The lookout that can provide such information is much more valuable than the man who can only sight on each fire and report its bearing and distance. Unfortunately, skilled lookout men are all too scarce. but the new man can become nearly as valuable as the old-timer if he is on the job, has his eyes open, and picks up all the information he can.

FEATURES TO WATCH

Experience has shown that excellent reports on lightning storms are obtained when the observer watches the following features of the report form:

1. Fill out the headings on each form completely. See that the official name of the lookout station is used, and not some merely local name. Give the correct section, township, and range location.

2. Do not fake any reports, and do not call up another lookout and copy his data. If you cannot answer the questions asked, simply say so, and explain the reason why, if you wish.

3. Each distinct cloud from which lightning or thunder is coming should be recognized as a lightning storm.

4. Use one line for each storm report and be sure to record in column 1 the date when each storm was first seen. It will be assumed that on all dates not included on the report form, during the period of occupancy of the station, no storms were visible from that point. Pay the most attention to storms nearest to you. Other observers will account for those thirty miles or more away.

5. In columns 2, 5, 11, 12, 13, and 14, be sure to state whether the hour is A.M. or P.M. Do not use the terms 12 A.M. or 12 P.M. Use "midnight" and "noon" instead. If the storm appears or disappears while you are asleep or away chasing smoke, for example, state that fact.

6. In columns 3, 6, and 8 report the cardinal direction as N, NE, E, SE, S, SW, W, or NW.

7. The information which you record in column 8 should show the position of the storm during the period covered by the observations recorded in columns 9 to 15 inclusive. No attempt should be made to fill out columns 9 to 16 for storms over thirty miles away.

8. Many lookouts have been interested in counting the total number of flashes from each storm as it passes over some particular topographic point; the Forest Service, Weather Bureau, Amer. Telephone & Telegraph Co., and other agencies also need such information <u>if it is accurate</u>. Do not record anything in this column, however, unless you are convinced that the figure is dependable. The information desired is a measure of the electrical activity of storms, which includes, as one phase, the chance of lightning striking an object or small area. Do not count and classify the peals of thunder unless you have also seen the lightning or know definitely whether the bolt was from cloud to ground or stayed within the clouds. So-called sheet lightning is

merely the reflected light from a bolt that was hidden by the clouds. Unless you see each bolt you cannot tell whether it passes from cloud to ground or cloud to cloud.

9. Past reports show that when two careful observers on adjacent lookout points merely estimate the percentage of flashes confined to the clouds, their estimates usually agree very closely. It has been found, however, that opposite sides of a large storm may exhibit very different electrical activity and each lookout should, therefore, record his own estimate for that part of the storm which he can see best.

10. In columns 11 to 15 inclusive, the data desired are for some particular point, mountain top, ridge, ranger or lookout station, etc., over which the storm cloud passes. See the diagrammatic representation in this leaflet showing the method of timing the progress of a storm over a selected mountain top when the storm is some distance away. In this diagram I represents the beginning of the rain from this storm cloud, II the beginning of the lightning, III the end of the lightning, and IV the end of the rain. As the storm passes over the largest mountains illustrated, the time, 2.05 P.M., would be entered in column 11 on the report form, 2.14 P.M., in column 12, 2.44 P.M. in column 13, and 3.45 P.M. in column 14. According to the illustration, this probably would be rated in column 15 as a wet storm. If a lookout were stationed on this mountain top he would record similar data in columns 11 to 14 inclusive, as the storm passed overhead, and would measure the amount of precipitation shown by his rain gage at the end of the storm, and record that measurement, perhaps 0.38 inches, in column 15.

It is important to remember that the information desired here is for the area under the storm cloud and affected by it. The point or area selected should be where the storm is nearest to you... If several storms are in progress simultaneously it is impossible to record data for all of them, and in such cases reports should be made only for the storm or storms nearest to you. The occurrence of numerous storms might be briefly stated, however.

11. The principle information requested under column 16 is whether or not that portion of the storm which you saw, and have reported on, started any fires. A "yes" or "no" answer will give this information. Secondly, there is need of determining the period of time between your first observation of the storm and your discovery of each of the fires caused by it. If you record, in column 16, the date,

hour, and minute of each of these discoveries, this elapsed time can be computed later. The time of discovery is requested for only the first four fires found, but these data may be recorded for all of the fires, if desired, by the observer. It is very important that each fire be charged to the storm which started it. A convenient method of recording date and hour of discovery is as follows: 8/1, 5:30 P.M. 2 fires; 8/2, 4:30 A.M. 1 fire, 10 A.M. 1 fire, 3 P.M. 1 fire.

If a lookout is in doubt concerning any of these instructions he should ask his ranger to explain them. Each observer who follows these instructions carefully can contribute materially toward better forest protection in this region. Some of the ways by which this may be done are as follows:

FACTS--	POSSIBLE APPLICATION--
1. Lightning storms are common in D-1 between June 1 and September 30.	1. Merely agrees with previous knowledge, that if the fuels are dry enough to burn, the protective organization may be called on to suppress lightning fires at any time during this 122-day period.
2. Peaks of danger from lightning storms usually do not occupy more than a total of 15 days between June 1 and September 30.	2. The organization to cope with the peaks of lightning danger may be called on to function fully during only 12% of the 122-day period. This uneven distribution of the load of work is one of the factors which raises the cost of forest protection. To reduce this cost other work may be provided to keep the protection men productively occupied when there is little or no danger of fire.

3. The peaks of lightning danger almost always occur in July and August.	3. Agrees with previous knowledge, and indicates the need of a full protective force only during these two months, as a rule.
4. The danger of lightning fires is not in proportion to the number of thunder-storm days.	4. Also agrees with previous knowledge and indicates the great importance of factors other than mere occurrence of lightning. Methods are now made available for measuring these other factors and so anticipating the number and danger of lightning fires more efficiently. For the region as a whole about half the lightning storm days are not very dangerous. The other half are of extreme importance.
5. About half of our lightning storms have no rain ahead of the lightning. If there is any rain ahead of the lightning its average duration is about 25 minutes. About one-third of our storms have no rainfall following the lightning. The average duration of this precipitation for the other two-thirds is 58 minutes.	5. The duration of rainfall ahead of the lightning, and following it, should be timed so that the storm can be classified as drier or wetter than average. Rainfall ahead of the lightning may prevent fires from being started. All of the rainfall is effective in preventing fires from spreading. Notify your ranger of the duration of rainfall under each storm.
6. The average duration of rainfall ahead of the lightning is 12 minutes for all storms, 9 minutes for fire starters, and 15 minutes for generally safe storms.	6. Any storm with less than 15 minutes rainfall ahead of the lightning should be reported as of the fire starting type; with over 15 minutes as of the generally safe type.
7. The average duration of rainfall following the lightning is 37 minutes for all storms, 31	7. Any storm with less than 44 minutes rainfall following the lightning should be classified

minutes for fire starters, and 44 minutes for generally safe storm.

8. So-called dry storms, delivering no precipitation whatever to the ground beneath, have been charged as being exceptionally dangerous. Only about 8% of all storms are entirely "dry", and of all dry storms only 32% start fires, whereas 34% of the wet storms start fires. We need records showing the number of cloud to ground strikes in both wet and dry storms.

9. The average storm which starts fires has more than half of its lightning striking the ground, whereas, the average storm which does not start fires has less than one-fourth of its lightning reaching the ground. Information is lacking concerning the absolute number of flashes and and strikes from storms.

10. For the Northern Rocky Mountain region about 24 lightning storms out of 100 cause fires. For the Beaverhead-Helena group of forests only 6% of all storms are fire starters; for the Lewis and Clarke - Missoula and Bitterroot 15% are dangerous; for the northwestern Montana group of forests 31% are fire starters; for Northern Idaho 47% and for the Nezperce-Selway 41% are dangerous.

as dangerous; with over 44 minutes as generally safe.

8. Lightning storms with no rainfall reaching the ground beneath are not, in general, any more liable to start fires than are wet storms, probably because fewer lightning bolts reach the ground. The character of the lightning is apt to be the controlling factor in dry storms. If strikes to ground occur, however, the chances of ignition and rapid spread are undoubtedly higher than with wet storms.

9. The storm with many lightning flashes, and over half of them reaching the ground should be classified as of the most dangerous type. The storm with few flashes and less than one-fourth of them reaching the ground can be classified as of the generally safe type. Intermediate conditions should be rated as dangerous rather than safe.

10. In eastern Montana it probably would not pay to make special preparations for the suppression of fires at the first warning of lightning storms. Undoubtedly it should pay, however, to prepare in nearly all cases in northern Idaho where practically half the storms are fire starters. In all cases the characteristics of each storm and the prevailing degree of forest inflammability should be given due weight in de-

termining the action taken before the fires are discovered.

11. Approximately one-fourth of all lightning storms in this region are first seen by the lookouts during the forenoon hours.

11. If the lookouts warn their rangers as soon as storms are seen there is ample time, in these cases, to take advantage of the daylight hours for moving men, equipment, etc., in preparation for fire suppression on the areas covered by these storms.

12. There is usually a period of three hours, between first seeing the storm and the first discovery of a fire resulting from it, four hours between sighting the storm and discovering the second resultant fire; five hours for the third, and over six hours for the fourth fire.

12. This means that if the lookouts report to their rangers as soon as they see lightning storms a 3 hour period is available for action before half the first fire reports are in. Four hours are available before half the second reports are in, etc. Consequently even though storms have not been predicted, there is usually a very appreciable period of time for action after the storms are first seen by the lookouts, and before the bulk of the fire discoveries are reported.

13. About 8% of the first four discoveries of lightning fires are made 48 hours or more after the storm is first seen. In 160 cases, during a 5 year period, no fires were discovered until 48 hours or more after the storm, then smokes began to show up.

13. These facts emphasize the need for intensive inspection of the paths of thunderstorms for several days after each storm. If notes or systematic records have been made of lightning strikes, these spots should be watched with special care, and may even be visited and inspected if possible.

14. The position of lightning strikes should be observed, and notes kept, when possible, by the lookouts to show whether each struck spot is later wetted by

14. Lightning fires occurring within the area rained on by a storm can be expected to spread more slowly and be controlled more easily than fires caused by strikes

rain or is left dry and as inflammable as before the storm.

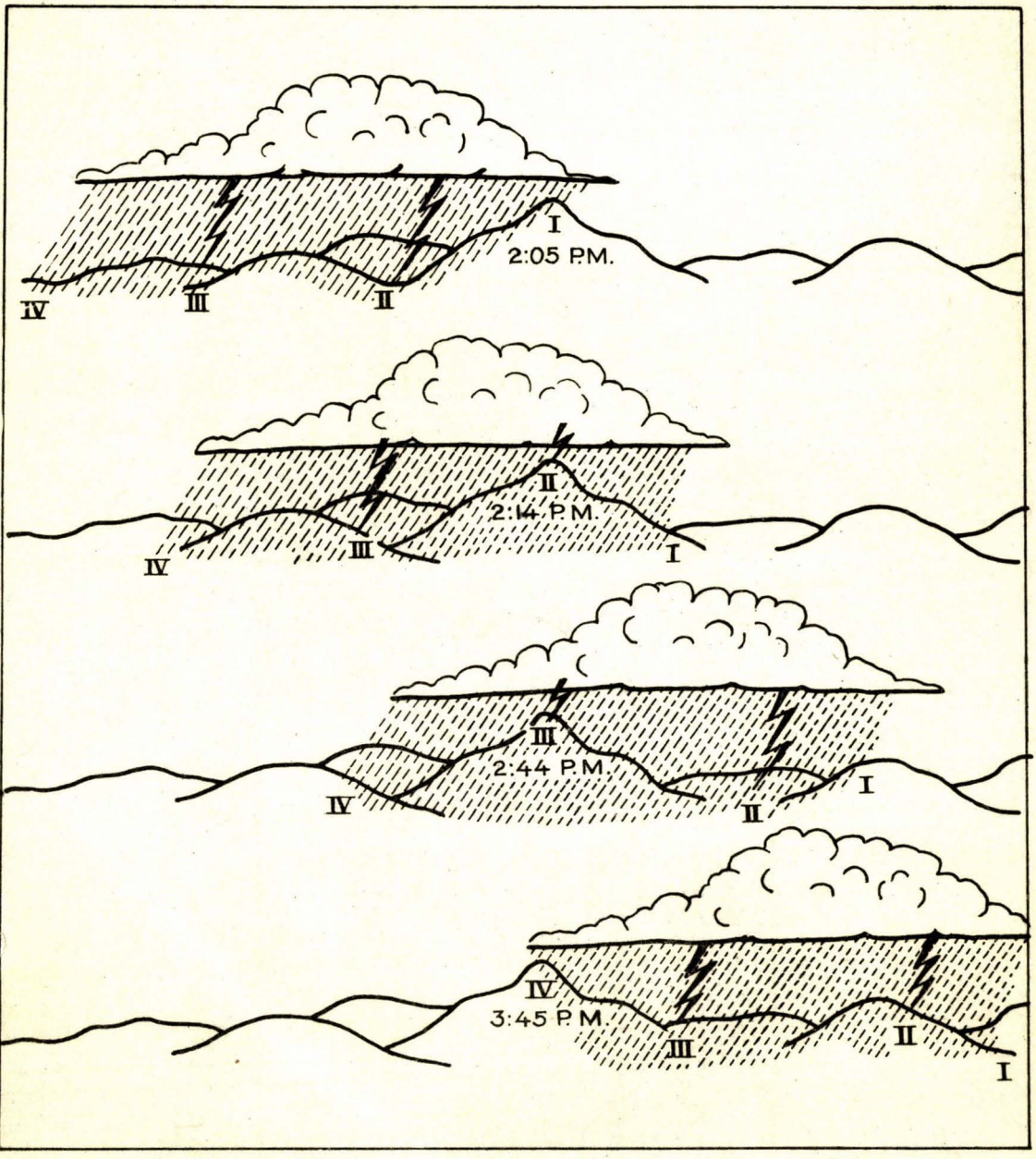
outside the rain area. In reporting the location of newly discovered lightning fires the lookouts should also include information on the probable rate of spread as affected by the rainfall or lack of it.

15. The careful observation of lightning storms and the filling out of the report forms is not primarily to accumulate data for later study. The principle value of this work in the future lies in the immediate use of these observations as one guide of the fire control action that can and should be taken when fires are probable yet before the bulk of them are discovered. The lookouts on the high mountain tops are the Eyes of the service, in this respect.

15. Fire lookouts, stationed on the higher mountain tops should be depended upon to report to their rangers, (1.) The first appearance of lightning storms; (2.) The probable area which the storm will cover, i.e., its path; (3.) The characteristics of the storm, hence the probability of fires being started; (.4) The location of each lightning strike, when possible, so that these spots may be watched most carefully for later outbreak of fire; (5.) The location of each fire and the factors controlling its probable rate of spread. On the basis of such information it should be possible to prepare more efficiently to cope with lightning fires before they are discovered and to control them in more cases before they become large.

All members of the forest protective organization should be fully impressed with the importance of making the lightning storm observations and acting upon the warnings which they provide. It is true, of course that a number of false alarms occur, but if the observations are made as described above and applied together with the detailed knowlwdge of experience in each particular locality the warnings undoubtedly can be given proper weight. The benefit of any doubt which exists should, of course, be thrown to the safe side.

Although this general method of improving the efficiency of forest fire control may find application in many regions the particular characteristics which have been stated as distinguishing safe from dangerous storms should be applied only in northern Idaho and western Montana, until found by measurement to be true elsewhere.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